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Why Gambit and Hexagon? *U.S. National Security and the Geopolitical Setting, 1957–1960*

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In the summer of 1960—one month before the first successful Corona launch—the U.S. government identified the need for higher resolution and broader area coverage as necessary follow-on national reconnaissance satellite programs: in July, the Satellite Intelligence Requirements Committee (SIRC) issued a report to the U.S. Intelligence Board calling for additional satellite systems with greater capabilities than planned for Corona.

Focusing on the impending Soviet strategic threat, the SIRC delineated three urgent intelligence gaps. The primary intelligence need was greater capability of *searching* for and *surveilling* Intercontinental Ballistic Missile (ICBM) launch sites in the Union of Soviet Socialist Republics (USSR). The secondary mission was to obtain more *detailed* intelligence on ICBM installations--i.e., imagery with greater resolution than Corona. Finally, imagery from the follow-on systems should provide *greater technical specificity* on the highest priority targets (Oder *et. al.,* 1991, p. 16).

Throughout the 1960s, 1970s, and into the 1980s, imagery from the systems (Gambit, 1963–1984; Hexagon 1971-1984) were to prove invaluable against many other threats from around the world, as well as provide valuable intelligence beyond adversaries' strategic capabilities;[1] but the primary *raison d'être* for the systems was to address the immediate Soviet threat in the summer of 1960. For it appeared at this juncture that undeniably the Soviets might be developing a first-strike capability. It appeared that the U.S. was indeed in severe danger of a surprise attack.

By 1960, the Soviets appeared to be far ahead of the U.S. in what was emerging as an arms and space race, a feat that had been possible only because of Sergei Korolev's R-7 rocket: Moscow had launched the world's first ICBM in the summer of 1957 and two months later, the world's first satellite *(Sputnik).* In 1959, they had successfully launched *Luna 2,* impacting the moon and thus becoming the first spacecraft to reach another celestial body.

By 1960, the U.S. had little or no intelligence on the impending Soviet threat. Subsequently, Corona was able to dispel the so-called "missile gap." While Corona enabled the "counting" of the missiles and missile sites, it lacked the resolution needed

1 See McDonald and Widlake, "**Looking Closer and Looking Broader:** *Gambit and Hexagon–The Peak of Film-Return Space Reconnaissance After Corona.*"

to gain greater insight into the Soviet strategic weapons program. It was to be the higher resolution Gambit satellites, particularly with the KH-8 beginning in 1966, and the surveillance capabilities of Hexagon in conjunction with Sigint platforms that the U.S. finally gained critical knowledge on Soviet strategic systems. Only via these systems would the U.S. "peer" into Soviet strategic force development.

How is it that in the summer of 1960, even a month before the first successful Corona launch, the U.S. Intelligence Community (IC) had the foresight to define so accurately the need for these two systems? What was the IC responding to, and what did it hope to achieve with these two systems?

It is only within the context of the 1957–1960 U.S. national security and geopolitical environment that the question of "Why Gambit and Hexagon?" can be fully answered. Accordingly:

- What was the state of the Cold War by 1957 and how is it that the Soviet Union—despite a poor economy—was able to achieve so many "firsts" and technological advancements in rocketry?
- How did the U.S. react to the Soviet "firsts" and what did the U.S. Intelligence Community (IC) specifically know in 1960?
- What really was the Soviet strategic capability by 1960 and how did Gambit and Hexagon provide the insight needed, explaining what Corona could not?

Indeed, an examination of the 1957–1960 context only highlights the foresight of the IC in envisioning these two systems—systems that would go on in the next two decades to not only fulfill their original missions, but also go beyond, and do so with stunning success.

1957: The Immediate Need for Intelligence Against the Threat

On 5 August 1957, a Central Intelligence Agency (CIA) U-2 overflight detected and took the first photograph of what appeared to be a CIA-suspected missile launch site in Kazakhstan—subsequently termed Tyuratam.[2] Reportedly, however, CIA photointerpreters were still analyzing the imagery from the flight when two weeks later, on 21 August 1957, the Soviet Union—after several failed efforts—from the same site launched the world's first Intercontinental Ballistic Missile (ICBM): an R-7 ("Semyorka" or "Little Seven"), whose dummy warhead impacted the Pacific Ocean about 6,400 km downrange. The Soviets then conducted a second successful test several weeks later—on 7 September.

Before the initial imagery from the U-2 flight confirming the existence of Tyuratam could even be developed, the Soviets proceeded with a related technological breakthrough—successfully launching the world's first artificial satellite from Tyuratam on 4 October 1957.[3]

In the wake of the Soviet's successful launch of the world's first ICBM and *Sputnik* in 1957, the President's Board of Consultants on Foreign Intelligence Activities (PBCFIA) issued a report to President Eisenhower recommending an evaluation of overhead reconnaissance systems, to include satellites. In a series of daring efforts between June of 1959 and Corona's first successful launch in August of 1960, U.S. intelligence officers, scientists,

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2 By 1957, the CIA had begun to suspect the existence of a long-range missile launch site near the Aral Sea. In May 1957, President Eisenhower approved U-2 overflights dedicated to locating missile and nuclear facilities, and specifically finding the suspected long-range missile launch site. When a U-2 pilot finally snapped the first photograph on 5 August—which he had found by flying along the rail-lines in the area—the U.S. had no name for the launch site. As CIA photointerpreter Dino Brugioni prepared to brief President Eisenhower on this initial image, he examined maps in an effort to find a place name. One map—made by the Germans in WWII—indicated a small community in the vicinity of the facility—"Tyuratam," which means "arrow burial ground" in Kazakh (Pedlow, pp. 135-36).

This site, a railroad station, had been chosen by the Soviets as early as 1955 as a long-range ballistic missile launch site precisely because of its isolated location—a sparsely settled region in the Kazakhstani desert about 200 kilometers east of the Aral sea, and far removed from the shorter range missile site at Kapustin Yar, which was more vulnerable to Western espionage collection. On their part, the Soviets have always termed the missile site "Baikonur," even though the town of Baikonur is 400 kilometers from the missile launchpads.

Terming "Tyuratam" "Baikonur" in international fora was actually a Soviet counter-deception effort to keep the long-range missile site a secret. Explaining the choice of nomenclature five decades later, Alexander Alexandrovich Maximov—Head of Space Forces of the Soviet Ministry of Defense at the time—explained that because of an existing international treaty, Moscow had to register the 21 August 1957 ICBM launch with the United Nations, indicating the date, time, and *place* of launch. He explained that Moscow was "not keen to divulge that information for security reasons." So intentionally Moscow decided to give the TASS news agency and the United Nations the name of a place hundreds of kilometers *away* from Tyuratam: Baikonur. (See Maximov's recollections, in Rhea, p. 328)

In subsequent years, the Soviets significantly expanded the Baikonur Cosmodrome; it became the primary Soviet launch center for not only long-range missiles, but also satellite and manned-spaceflight programs. Its multiple launch capabilities were included as critical inspection sites under the Strategic Arms Reduction Treaties (START) treaties.

3 Other Soviet "firsts" in space history followed shortly thereafter from precisely the same Tyuratam launch site #1, and all with Sergei Korolev's R-7 launch vehicle. On 12 September 1959, the Soviets successfully launched *Luna 2,* impacting the moon and thus becoming the first spacecraft to reach another celestial body. Similarly, *Luna 3,* launched from Tyuratam on 4 October 1959, swung around the moon and, with the sun behind it, took the first photographs of the far side of the moon. The film was developed automatically onboard, scanned by a television unit, and transmitted by radio to the ground (Harford, p. 143ff). And finally in 1961, from the same launchpad the Soviets launched the world's first manned spacecraft, Vostok-1 with cosmonaut Yuri Gagarin.

and rocket engineers, working with a sense of urgency, quickly mounted a focused effort to launch the world's first photoreconnaissance satellite into space (McDonald, p. 40ff).

The pressing U.S. national security need to gain more hard intelligence on Soviet strategic capabilities had become even more urgent in May of 1960 after U-2 pilot Francis Gary Powers was shot down four and one-half hours into his flight by an SA-2 surface-to-air missile, thus ending U-2 overflights. Ironically, his primary targets had been the Tyuratam Missile Test Range, the military-industrial sites near Sverdlovsk, and Plesetsk—600 miles north of Moscow, and a critical site where U.S. intelligence officers suspected Moscow was deploying the first *operational* ICBMs. Indeed, "Operation Grand Slam" was the most daring of all U-2 flights, since it was intended to cover so much of the Soviet Union. Moreover, the timing of the flight was critical: if these key sites were not photographed between May and July, the sun's angle would preclude further imagery for another year (Pedlow, 1992, p. 172 ff).

Moscow vigorously protested and publicized the incident; President Eisenhower had no choice but to cancel overflights. Thus it was that by the summer of 1960, the U.S. had little or no hard intelligence on the perceived looming Soviet advantage in strategic weapons. Analysts at CIA suspected that Moscow might be deploying ICBMs at Plesetsk and Tyuratam, which is why Gary Powers' U-2 flight mission had been so important. And Corona's ultimate success was still uncertain. Finally, throughout the U.S. government there was an intense awareness that, even if Corona were successful, additional satellite systems with greater capability were acutely needed.

Thus did the U.S. arrive inescapably to the conclusion that Corona follow-on systems were urgently needed: Gambit and Hexagon.

1957: The State of the Cold War

> *"I am certain that we shall quite soon have a ballistic missile with a hydrogen bomb that can fall anywhere in the world."*
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> —Soviet Premier Nikita Khrushchev, as quoted by *Time,* "Foreign News: Fist for a Fist," 7 May 1956

> *"The next war will be 'fought on the American continent, which can be reached by our rockets....' "*
>
> —Soviet Premier Nikita Khrushchev as quoted by *Time,* "The Nation: Missiles for NATO," 25 November 1957

The 1950s were by and large characterized by periods of increased attempts at *rapprochement* between Washington and Moscow and periods of increasing tension.[4] Ironically the progress made towards *rapprochement*—namely the Geneva summit talks aimed towards reducing the impending arms race—faltered precisely due to the very thing Gambit and Hexagon imagery would ultimately provide, namely verification of the Soviet strategic capability. And without verification and the ability to reach an arms control agreement, unresolved tensions from the end of the 1940s would harden into a Cold War stalemate, exacerbated by the development of long-range delivery systems for nuclear weapons, Soviet Premier Nikita Khrushchev's braggadocio, and fears in the West in lieu of hard intelligence.[5]

In 1945 there had been nothing per se to presage that inevitably the next four and one-half decades would harden into a 20th century Cold War stalemate between the U.S. and the Soviet Union, with periods oscillating between tones of aggression followed by overtures toward détente.[6] However, a series of developments in the late 1940s and early 1950s set the pattern that would emerge: efforts were made for summits geared towards reaching peaceful resolution of conflicts; simultaneously, however, actions on the ground would often escalate tensions and preclude progress at summits. Many conflicts were left unresolved and would continue to erupt during the next four decades. For example, the contentious "German Question" was never really resolved: what had looked like a reasonable solution in 1945—that the four conquering Allies would occupy zones of the

4 Needless to say, the secondary literature on the Cold War is extensive and extends beyond the scope of this analytic essay. For a listing of major works, see the Carnegie Mellon University's Cold War Science and Technology website at http://www.cmu.ed21st centuru/coldwar/annot.htm; the Cold War Studies project at Harvard University at http://www.fas.harvard.edu/-hpcws/index2.htm; and the Cold War International History Project, the Woodrow Wilson International Center for Scholars in Washington, D.C., at http://cwihp.si.edu/default.httm. Though somewhat dated, for overviews also see: John Lewis Gaddis, Long Peace: Inquiries into the History of the Cold War; "The New Cold War History" (1998) at http://www.unc.edu/depts/diplomat/AD_Issues/amdipl_9/gaddis_coldwar.html, and, more recently, Gaddis, The Cold War: A New History, 2005. Also, see the review by Michael Beschloss, "Look Back in Relief," The New York Times (15 January 2006).

5 An early Cold War history, written by D.F. Flemming, first published in 1961, describes the 1955–59 period as "The Second Cold War," based on the failure of the July 1955-October 1956 initial arms control meetings in Geneva. Even more interesting is Flemming's two volume history as a historical document. Writing in 1961, one of his concluding chapters is amazingly entitled "Why the West Lost the Cold War." See Flemming's *The Cold War and Its Origins.*

6 There is a significant body of literature on the origins of the Cold War, as well as what has been an extremely emotional debate as to which side has been more culpable in starting and escalating the Cold War. For an overview of this often acrimonious debate among historians, see J. Samuel Walker, "Historians and Cold War Origins: The New Consensus," in Gerald K. Haines and J. Samuel Walker, Editors, *American Foreign Relations: A Historiographical Review,* pp. 207-36.

Put succinctly, historians in the debate usually fall within one of several categories. Those of the *orthodox* school —the prevailing consensus in Cold War literature of the 1950s and early 1960s—blamed the Soviet Union for the Cold War, arguing that the U.S. had no choice but to contain and where possible to reverse the expansion of an aggressive Communist state dedicated to overthrowing Western capitalism and democracy. By the end of the 1960s, however, a growing body of scholars (principally Walter LaFeber, Lloyd C. Gardner, Barton J. Bernstein, Stephen E. Ambrose, and Joyce and Gabriel Kolko) were publishing major studies questioning this interpretation. These adherents of the *revisionist* school blame the U.S., arguing that the U.S. was determined to expand capitalism by securing unlimited access to the world's markets and resources, aggressively attempting to crush all revolutionary movements in order to accomplish its expansionism. Finally, adherents of the *post-revisionist* school blame both the U.S. and the USSR, arguing that both sides took actions that provoked hostile reactions entailing an unending "action-reaction" cycle. J. Samuel Walker indeed argues that by the late 1970s—after extensive research and debate—traditional and revisionist interpretations have produced a "new cold war consensus"—both the U.S. and Russia shared responsibility for the onset of the Cold War in approximately equal proportions.

former Reich, to include a four-power occupation of its capitol Berlin—by 1960 had led to the formation of two separate states on the frontlines of the Cold War divide. Other unresolved tensions from the period would likewise feed into the eventual Cold War stalemate: for example, in 1948 the Communists achieved a coup in Czechoslovakia; China fell in 1949 to Mao's Communists with the subsequent Sino-Soviet Bloc between Moscow and Beijing; and the early 1950s saw North Korean aggression (aided by China) in Korea.

However, with Stalin's death in 1953 there appeared—at least for several years—a resolve on each side to lessen tensions. The collective leadership after Stalin was convinced that their major priority needed to be improving the poor economic conditions and outlook of the Soviet Union; relaxing tensions with the West was viewed as being an important component of their need to shore up the failing Soviet economy. Soviet Premier Georgi Malenkow reportedly even looked favorably on summit talks to resolve the German Question. Meanwhile, President Eisenhower and his foreign policy team were convinced that peaceful co-existence was a real possibility but the U.S. must ultimately be "ahead" in the Cold War and counter perceived Soviet aggression; however, not unlike their Soviet counterparts, the Eisenhower Administration, too, was deeply concerned by the costs of national security programs and the large U.S. national debt[7] (Leffler, p. 89ff).

Thus, by the end of 1953 the Eisenhower Administration had reached a policy of deterrence, containment, and prudent rollback, i.e., that the U.S. possess the capability of inflicting massive retaliatory damage through offensive capability while pursuing arms control—all designed to prevent Soviet aggression. Nuclear deterrence and massive retaliation would enable the U.S. to cut the budget, saving money on conventional forces.

The Korean War had a major impact on the Eisenhower Administration and was to have a major influence upon policymakers' formulation of a military strategy towards the Soviet Union during the 1950s. The unexpected aggression on the part of the Communists in Korea induced Eisenhower to believe increasingly that nuclear deterrence had to serve as a fundamental foundation of U.S. strategy. The deterrent strategy was first publicized in a speech by Secretary of State John Foster Dulles on 12 January 1954. Nuclear deterrence—and the threat of massive retaliation—would prevent war.[8]

Also in January, 1954, for the first time in five years, U.S., French, British, and Soviet foreign ministers met in Berlin in an effort to hammer out an acceptable resolution to the German Question. The U.S. position was firm—free elections in all of Germany as a prelude to German unification, with the Soviets disagreeing. All parties, however, agreed to hold another conference, this time in Geneva, and deal with an entire host of issues to include Korea, Indochina, and arms control.

7 Somewhat ironic from today's vantage point, when Eisenhower learned at a July 1953 National Security Council meeting that the U.S. national debt was about to exceed eight billion dollars and that the U.S. Congress would have to raise the debt ceiling, he reportedly remarked: "We are in a hell of a fix" (Leffler, p. 125).

8 There are many excellent secondary sources on the Eisenhower Administration's national security strategy. I recommend beginning with the selected bibliography on the website of the Dwight D. Eisenhower Presidential Library and Museum at http://eisenhower.archives.gov/Research/Bibliography/Bibliography.html.

The July 1955 Geneva summit with the "Big Four" was intended to begin long-term negotiations on a broad range of contentious issues, to include trade agreements, the emerging arms race, and possible disarmament treaties; it is here that President Eisenhower proposed an "Open Skies" plan, calling for an international aerial monitoring system.[9] President Eisenhower's "Open Skies" initiative was an effort to avert the possibility of a surprise attack by either side—an initiative that Moscow eventually rejected, claiming that U.S. overflights by reconnaissance aircraft could be used for extensive spying.

In a remarkable quirk of fate, Nikita Khrushchev attended the 1955 meeting, and came away with a predominant lingering belief that Moscow had been humiliated at the Geneva meeting—primarily due to the qualitative difference between U.S. and Soviet aircraft capabilities. Western delegations arrived on four-engine planes, but the Soviets on two-engine planes. His son, Sergei Khrushchev, claimed that until he died his father never forgot his humiliation from this fact (Taubman, W., p. 350ff).

As both sides continued to develop, test, and stockpile nuclear weapons during the 1950s, both Moscow and Washington gradually reached agreement that some sort of international limitations on nuclear testing were needed. However, a series of talks and initiatives were plagued by the question of verification—with verification becoming ultimately the stumbling block to a comprehensive ban on testing. The West was determined to ensure that an international agreement on nuclear testing would not be vulnerable to clandestine violation; however, the U.S. lacked the means of verification. On their part, the Soviets insisted that formal verification measures were not necessary—and therefore Soviet territory did not need to be inspected.[10]

Meanwhile, these initial arms control talks were not transpiring in a vacuum. Several key developments and events in 1956 heightened public apprehension and prompted an increasing skepticism about the fruitfulness of the Geneva negotiations: the long-simmering tensions in the Middle East in the Suez Crisis; increasing Cold War conflicts in the Third World to include Indochina; and the November 1956 Soviet invasion of Hungary.

Even before the Soviet occupation of Hungary, U.S. distrust of the Communist world was growing, due to these various Third World skirmishes. By March of 1956, an escalating number of the most respected pundits in U.S. journalism were in unison in lamenting what they perceived to be a lack of U.S. policy in *deterring* Soviet expansionist ambitions: *The New York Times* reporter James Reston noted that the Communist political and economic offensive in the Middle East and South Asia was invoking the "greatest apprehension since the Korean War," and suggested that the U.S. might be losing "the

9 On the 1955 Geneva summit, see Gunter Bischof, *Cold War Respite: The Geneva Summit of 1955.*

10 President Harry S. Truman had established the Science Advisory Committee in 1951 in the Department of Defense. In response to the Soviet 1957 ICBM and *Sputnik* launches, President Eisenhower upgraded the committee and moved it to the White House in November of 1957. For an overview of the role of scientists, see Zuoyue Wang, *In Sputnik's Shadow: The President's Advisory Committee and Cold War America.* For a treatment of scientists and the role in the need for verification in arms negotiations, see James Killian's *Sputnik, Scientists, and Eisenhower and Benjamin P. Greene, Eisenhower, Science Advice, and the Nuclear Test-Ban Debate, 1945-1963.*

initiative in the world struggle with the Communists"; pundit Walter Lippmann claimed that in the past six months "we have suffered the biggest setback since the Communist victory in China"; and Joseph and Stewart Alsop opined that after the 20th Congress of the Soviet Communist Party,[11] the Soviet rulers were confident and "sure that the tide of history is now flowing ever more rapidly in the direction of the world hegemony they seek" (*Time,* 1956a).

This apprehension about Soviet intentions and capabilities only escalated in October and November when Moscow sent over 150,000 troops and 2,500 tanks into Hungary to quell what had become a spontaneous resistance to Soviet-imposed policies. Echoing widespread reaction in the West, *Time* editors ominously noted: "The belief in Soviet good intentions [i.e., the thaw in the wake of Stalin's death in 1953]...has been grievously shaken" (*Time,* 1956b).

By a year and half later, the voices criticizing U.S. policy would reach a new fevered pitch when the Soviets launched the world's first ICBM, followed shortly by the world's first satellite. To most Americans, it appeared the U.S. and West were indeed "losing" the Cold War.

1957: A Paradigmatic Shift in 20th Century Warfare—Nuclear Strategic Bombers and the ICBM

> *"The ICBM is the nearest thing to an 'ultimate weapon,' complete with delivery system, that has ever been conceived..."*
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> —*Time*, 30 January 1956, "Science: Missiles Away"

> *"Production of rockets is now a matter of mass delivery—like sausages that come out of an automatic machine."*
>
> —Soviet Premier Nikita Khrushchev to the UN General Assembly, October, 1960 (As quoted in *Time*, 24 October 1960, "United Nations: The Thunderer Departs")

The Soviet 1957 "firsts" with the ICBM and *Sputnik* shocked the American public. How is it that the Soviets had achieved such technological feats? Certainly the U.S. public had been alarmed by the earlier unexpected Soviet ability to develop both the atomic and hydrogen bombs. But the lethality of these bombs and their ability to induce fear were directly proportional to the ability of man to invent suitable long-range delivery systems. By the end of the 1950s, with strategic nuclear bombers and Intercontinental Ballistic

11 It was also at the 20th Congress of the Communist Party of the Soviet Union in February 1956 that Nikita Khrushchev gave his "Secret Speech" denouncing the personality cult and dictatorship of Joseph Stalin. However, only parts of the "Secret Speech" were publicized in 1956, with the full speech not published until as late as 1989. So at the time journalists like the Alsops had a particularly negative reaction to the 20th Congress and what they believed was now irrefutable proof of Soviet expansionist intentions. Basing their assessment on observations from U.S. diplomats and Soviet experts (such as Ambassador Charles E. Bohlen), the Alsops were struck by the "remarkable" self-confidence of party leaders at the Twentieth Congress. See "U.S. Miscalculates Communist Strategy," 5 March 1956 in *Time.*

Missiles (ICBMs), both sides had developed this capability. However, by the mid-1950s Moscow—due to geography and its difficulties in developing strategic bombers—began to accelerate its development of the ICBM, with an ambitious goal of actually *deploying* numerous operational ICBMs throughout the Soviet Union.

Of the two long-range delivery vehicles, in certain senses the ICBM was the more formidable weapon. It required no pilot. From a continent away, and within eventually only 30 minutes, each side could deliver a lethal thermonuclear warhead to the adversary's territory. And it was ultimately the Soviet threat in this area—its real achievements in ICBM development as well as related "firsts" in space between 1957 and 1960—that escalated the fears in the U.S. For the first time in nearly 200 years, the vast Atlantic and Pacific Oceans could no longer protect the U.S. mainland.

To put it in perspective: the 9-megaton warhead--the size of the weapon on the U.S. ICBM strategic missile systems in the early 1960s—detonated at the Washington Monument would more or less level Washington, D.C. out to the Beltway in every direction, a distance of 15 miles (Graham, p. 15). In a matter of 30 minutes, a Soviet ICBM could strike Washington, D.C., and the U.S. President and national security apparatus had only *20 minutes* to decide whether to launch strategic nuclear missiles before the detected Soviet missiles arrived.

To some degree, only gradually during the 1950s did the U.S. lose its smug sense of technological superiority as the Cold War heated up in the 1950s. After all, the U.S. had a far superior economy, and the average U.S. citizen's standard of living was extremely impressive when compared to that of his Soviet counterpart. Moreover, the U.S. had been first in developing nuclear weapons. Thus, the U.S. had been caught by surprise when the Soviets announced their first successful detonation of an atomic bomb in 1949.

By the mid 1950s, it appeared to the West that the Soviets had developed a large force of strategic bombers able to deliver nuclear weapons across the Pacific and Atlantic Oceans. Soviet intercontinental bombers first appeared in the July 1955 Moscow air show. The bombers flew in "waves," giving the West the impression that Moscow had more bombers than they had anticipated; in point of fact, there were only a few bombers that circled around, although the U.S. had no means of knowing this in 1955. Thus, between 1955 and 1957, the U.S. Air Force estimated the Soviets had as many as 700 or 800 strategic bombers.[12] A year later, in testimony before the U.S. Congressional Air Force Subcommittee of the Senate Committee on Armed Forces, General Curtis LeMay was predicting that by 1960 the Soviet Union would have substantially more Bisons and Bears than the U.S. would (Sheehan, p. 151). However, U-2 aerial reconnaissance flights had by 1958 effectively dispelled the so-called "bomber gap," with U.S. intelligence analysts able to definitively verify that the Soviets never deployed more than 150, and not the 700-800 estimated by the Air Force (Pedlow, p. 111ff).

12 The literature on the so-called "bomber gap" in the 1950s is quite extensive. The reader is advised to begin with the CIA's Center for the Study of Intelligence (CSI) collection of NIEs with commentary in *Intentions and Capabilities*, edited by Donald P. Steury, p. 5 ff. and collection of essays, *Watching the Bear,* at CSI's unclassified website.

Even more significantly, aside from the U.S. overestimation in the number of Soviet heavy bombers, the bombers never actually presented an immediate threat of a surprise attack. This was because of the fact that U.S. analysts erroneously believed the Soviets were farther along in developing an intercontinental capability of aerially refueling the bombers—which in point of fact even by 1959 the Soviet Air Force had not developed. Without a refueling capability, Soviet bombers could fly only one-way intercontinental missions to the U.S. Moreover, the strategic bombers were based deep within the Soviet Union, and would have had to be staged forward before flying to the U.S. Clearly, doing this would give away the Soviet intentions and make them vulnerable to U.S. preemptive strikes.[13] Khrushchev himself played a critical role in Moscow's decision to step back from relying on the heavy bomber (Khrushchev, p. 455ff, and p. 469).

All in all, Moscow's increased focus on the ICBM was directly a result of the fact that its strategic bombers were unable to serve as an effective long-range nuclear delivery vehicle. Unlike the U.S., the Soviets could not deploy its bombers near the adversary's borders and would have no capability of strategic surprise. In contrast, by the mid-1950s, the U.S. strategic forces included more than 1,200 bombers capable of delivering about 2,000 weapons to targets in Soviet territory. Even as late as 1962, the Soviets had only about 160 bombers capable of delivering about 270 nuclear weapons to U.S. territory (Podvig, 2001, p. 4).

Thus, the Soviets felt compelled to quickly develop the ICBM as their primary intercontinental delivery vehicle for nuclear weapons. And it is truly to Stalin's credit that beginning in 1945, despite a military and economy in shambles,[14] he rapidly began to allocate resources to nuclear devices and long-range delivery systems, an initiative that would result in the Soviet advantage in long-range missiles in surprising breakthroughs between 1957 and 1960. As one expert has astutely noted, "Of all Stalin's imprints on Soviet and world history, the technological is perhaps the least appreciated…" (McDougall, pp. 41-41).

Clearly, as conquering powers in 1945, the Soviet Union, the U.S., and Great Britain all profited from the advanced technological know-how of the Germans at the end of World War II, augmenting their own indigenous missile development with the advances Hitler had been making on the V-1 and V-2. However, Moscow had several serious disadvantages. After having fought for over four long years on Hitler's "Eastern Front" in some of the most brutally bitter battles in the European theater, Stalin's military was utterly depleted and the Soviet economy was in shambles.

Secondly, however, the U.S. and Great Britain were better positioned to gain an advantage in acquiring the Third Reich's technological know-how, since they were first to occupy the province of Thuringia, where the main V-2 manufacturing plants were located. Thuringia, as part of the Yalta Agreement, was eventually to become a Soviet zone of occupation; forced thus to pull out, the British and the Americans seized and took with

13 *Ibid.*

14 For a treatment of the poor state of Soviet capabilities in 1946, see Harford, p. 93ff.

them practically all the V-2 equipment, to include missiles, control systems, components and ground equipment (Rhea, p. 102). Moreover, through "Operation Paperclip," the U.S.—before departing the Soviet zone—ensured that the West "processed" into its zone some 150 leading German V-2 scientists and rocket experts.[15]

Thirdly, however—in an irony of history—it had been Josef Stalin himself who had contributed senselessly to creating the pitifully weak state of the Soviet military rocketry in 1945 (Harford, p. 91). Beginning in 1936, in a fit of inexplicable rage and probably induced by his tendency towards paranoia, Stalin had begun a series of political repressions, involving a purge of Communist Party and government officials, the *kulaks,* and the Red Army leadership.[16] He thereby practically destroyed what had been an extremely innovative Soviet rocket program.

During the 1930s, Soviet work on rockets and efforts to achieve space flight had actually been quite advanced. Indeed, as one historian has accurately noted, until 1937 Soviet rocketry was "almost on par with that in Germany, which in turn was far ahead of that anywhere in the rest of the world, including the United States" (Stine, p. 125). In the 1930s, Sergei Korolev worked for the powerful Soviet Armaments Minister Mikhail N. Tukhachevskiy, the highest ranking Soviet military officer in the Red Army. Tukhachevskiy was intrigued by the possibility of rocket weapons and enthusiastic about the idea of space travel. He procured funding and rocket research flourished: in 1933 the first free flight of a Soviet-made liquid-fuel rocket took place at an army base near Nakhabino, outside of Moscow (Ober, p. 18; Harford, p. 29ff).

By 1937, however, these innovative nascent rocket research efforts were abruptly terminated when Stalin began to arrest Red Army leaders. His ostensible justification was a series of purported correspondence between Marshal Tukhachevskiy and the German high command. Tukhachevskiy was taken prisoner, interrogated, tortured and finally "confessed" that he was actually a German agent. After a "show" trial, he was summarily shot in the head in 1937.

Similarly, many other leading rocket scientists and military officers were arrested and interrogated, tortured into "confessing" lack of loyalty to Stalin, summarily shot or imprisoned, often in the *Gulag.* Sergei Korolev was arrested in June 1938, and charged with misusing rocket research funds. After being tortured in the Lubyanka prison, he was "tried" and sentenced to 10 years of hard labor. After a brief stay in a transit camp, he was sent to a labor camp in the harsh Kolyma region in Northeast Siberia. Conditions were brutal—freezing temperatures, lack of food, lack of basic hygiene, excessively hard labor, and brutal treatment by guards meant that not many inmates survived the harsh conditions in the brutal Siberian camps.[17]

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15 "Operation Paperclip" was an Office of Strategic Service (OSS) program in 1945 to recruit Hitler's top scientists. For accounts of this operation, see: Linda Hunt, *Secret Agenda;* Burghard Ciesla *et.al., Technology Transfer Out of Germany After 1945;* and Clarence Lasby, *Project Paperclip.*

16 It was the historian Robert Conquest who first treated the era in fuller detail in his 1968 history entitled *The Great Terror.* He intentionally chose the phrase "terror," based on the "Reign of Terror" during the French Revolution.

17 For a well-done comprehensive treatment of Korolev, see James Harford, *Korolev.*

In 1939, Korolev was transferred from Kolyma, re-tried, and transferred to a *Sharashka*. Sharashkas were special prisons for intellectuals and the educated. Andrei Tupolev, the airplane and strategic bomber designer, was searching for rocket experts, and reportedly had requested him. Apparently, it was during this period of incarceration in a Kazan Sharashka that Korolev began to work on the ballistic missile concept. In June of 1944 he—along with Tupolev and the rocket scientist Valentin Glushko[18] —was formally discharged by a government decree, although the charges against him were not dropped until 1957 (Harford, p. 97ff; Gruntman, p. 273ff).

By 1945, however, with the beginning of the first rumblings of the Cold War, Stalin made up for his prior mistakes and rapidly took the offensive in accelerating the Soviet Union's ability not only to develop both the atomic and hydrogen bombs in rapid succession, but also to re-coup the gains that had been made on rockets in the 1930s. As early as 13 May 1946, the Council of Ministers of the USSR dedicated a meeting to the "matters of the rocket weapons," establishing the basic organizational structure for an indigenous development of these weapons based on the German V-2. Soviet engineers and rocket scientists were sent to Germany and charged with returning with any material they could seize. The decree also called for the establishment of a test center and design bureaus and ordered that 500 specialists be selected for rocket work (Gruntman, p. 275ff).

A year later, in 1947, Moscow established the first large-scale missile test range, the "State Central Rocket Testing Range N. 4" near the town of Kapustin Yar on the eastern bank of the Volga River, 70 miles southeast from Stalingrad. Until the establishment of Tyuratam in the 1950s, Kapustin Yar was to be the main center for Soviet missile testing. It was here that Korolev was sent and from where he spearheaded much of the initial work on cruise missiles and shorter range—with an eye towards longer range—rockets.

From the outset, however, Stalin's primary goal was that the Soviet Union develop the long-range missile. In 1947, at a Communist Party Politburo meeting he stressed that priority should be given to "rocketry" and that the Soviet Union needed to develop "transatlantic missiles." No limits should be placed on the funding available to achieve that goal (Rhea, p. 287). On 14 April 1947 Stalin summoned Korolev to a key meeting of a special commission that called for the development of a long-range plan for rocket technology development. The group consensus was that German V-2 technology was past its prime—a new approach was needed for the development of an ICBM (Harford, p. 97).

18 Valentin Glushko, a Soviet engineer, was the principal Soviet "Chief Designer" of spacecraft and rockets during the Cold War. See Mike Gruntman, *Blazing the Trail.*

Korolev began work at Kapustin Yar[19] for what would eventually become the "R" series in Intermediate Range Ballistic Missiles (IRBMs). [See Table 1.]

With Stalin's death in March of 1953, the Soviet government reexamined the strategic weapons program. On 12 August 1953 the Soviets successfully tested a hydrogen bomb, only 10 months after the U.S. had detonated a 10.4 megaton bomb. Shortly thereafter, at the Presidium at the Council of Ministers, a decision was made to upgrade Andrei Sakharov's bomb to a 1-2 megaton yield and attach it to a huge intercontinental missile. It was at this meeting that Korolev played a key role.

As indicated, Korolev had been working on missiles at Kapustin Yar, particularly the intermediate range R-3. According to several accounts from those at meetings, Korolev shocked everyone by suggesting that the R-3 program be cancelled, arguing that the missile had only a 3,000 km range and therefore was not what was needed. He believed what the Soviet Union really needed was an ICBM with a range of 7,000 to 8,000 km, with a range capable of hitting the continental U.S. (Zaloga, 1993, p. 135ff).

At a 30 May 1954 follow-on meeting, Korolev promised to have the R-7 long-range missile ready by 1957. By fall of 1954, he had completed a preliminary design (Zubok, p. 124). And in 1954, according to Vladimir Pavolvich Barmin, Director General of the General Machine Building Design Bureau, work began on R-7 missile ground support equipment (Rhea, p. 37).

Next, a new long-range missile launch site was needed. Kapustin Yar was too small for long-range extensive missile work and testing. Moreover, its location near population centers was a disadvantage, both in terms of potential casualties but also due to the need to protect the highly secretive work on strategic ballistic long-range missiles. A special commission composed of both military and civilian experts was tasked to find an ideal site. The commission ended up with three possibilities: Makhachkala in Dagestan on the Caspian Sea; the forested region of the Mordovian Republic; and a site near the Tyuratam railroad station in the Kazakhstan desert. However, it became quickly clear to the commission that neither of the two first options were feasible. The forest in Mordovia was too close to population centers and maintaining secrecy would be a challenge; and the area in Dagestan was surrounded by hills that made radio contact impossible during

19 Moscow selected Kapustin Yar as the first ballistic missile test range because of its access by rail and relative proximity to industrial infrastructure in the city of Stalingrad (Volgograd) on the Volga River. During the early years, the Soviets tested here V2 missiles captured from the Germans at the end of World War II. On 18 October 1947 the first rocket—a German A-4—blasted off the range. It was at Kapustin Yar on 2 February 1956 that for the first time a missile (an R-5M) carried a live nuclear warhead, which detonated 1,200 km downrange. When first built, Kapustin Yar was only a tent city; in a somewhat ironic twist of history, the tents used were U.S. Army tents—part of the Lend-Lease Program (1941-1945) designed to provide assistance to the Soviets against Hitler. (Stine, p. 133).
Kapustin Yar was not only the site of the first Soviet rocket launch and first missile launch with a live nuclear warhead, it was also the site where an entire class of Soviet missiles was eliminated. With the assurance that U.S. national reconnaissance and on-site inspections could provide the needed verification, in 1988 Moscow and Washington signed the Intermediate Nuclear Forces (INF) Treaty. In July of 1988, eliminations were begun at the Kapustin Yar Missile Test Complex with the elimination of the first SS-20 missile. The last was eliminated on 12 May 1991.

launch. Tyuratam was ideal—situated on a rail line in an extremely sparsely populated area of Kazahkstan. Moscow approved the site for the new work, and code-named it "Taskhkent-50" (Rhea, p. 322ff).

Initially life at Tyuratam was extremely hard. People stationed there could not tell anyone where they worked. Beginning early construction in 1955, the first Tyuratam commander—some five decades later—describes it as having been a "hell hole," noting: "The early construction phase was particularly arduous for everyone involved. We simply had to bite our lips and get on with the work, keeping in mind its importance for our country" (Rhea, p. 336).

The actual construction of the launch range and pad began in 1955 (and was finished by 1957); the first static test firings of the R-7 began in February 1956. However, there were numerous challenges. For example, transporting the test missile became a major challenge, since it was too large to be transported in an assembled state. Moreover, the liquid oxygen missile was extremely dangerous to fuel if not done properly and carefully.

Finally, however, by February of 1957 Korolev began preparing for the first launch. The first launch scheduled for March, however, was unsuccessful and had to be called off before liftoff. A second attempt in April also failed to launch. Finally on 15 May 1957, the first R-7 finally lifted off the pad. But it exploded over the test range. Korolev wrote to his wife: "...my frame of mind is bad. I will not hide it. It is very difficult to get through our failures...There is a state of alarm and worry..." (Zaloga, 1993, p. 144). Then, another attempt in June failed. Finally, on 21 August 1957, Korolev successfully launched his R-7 ICBM.

Soviet technological breakthroughs between 1957 and 1961 were undeniably due to the genius of Sergei Korolev. But during the 1950s as he worked furiously to get the R-7 working, he was technically still a "non person." It was not until 19 April 1957 that the Khrushchev government finally notified Korolev of his rehabilitation. On that fateful day in August of 1957, Korolev almost certainly enjoyed a brief moment of sheer wonder. After so many failed launches, the ICBM successfully launched and the dummy payload soared some 6,400 kilometers, eventually landing near the Kamchatka peninsula, not far from Kolyma where Korolev had barely survived the *Gulag*.

U.S. Lack of Knowledge: Fear in Lieu of Hard Data, While Searching for Technical and Scientific Solutions, 1957–1960

> *"We have found no evidence in Russian foreign and military policy since 1945 to refute the conclusion that U.S.S.R. intentions are expansionist...The evidence clearly indicates an increasing threat which may become critical in 1959 or early 1960."*
>
> —*The Gaither Report,* 1957

"Strategic warning...will become even more valuable as the maximum achievable tactical warning time shrinks to a matter of minutes in the case of a missile attack."

—*The Gaither Report,* 1957

"Let me return to that memorable year, 1957. Our missiles had made the United States tremble."

—Former Soviet Premier Nikita Khrushchev, *Memoirs,Vol. II,* p. 458.

Even though press and public criticism of the Eisenhower Administration had been growing since Soviet and Chinese actions in the Mideast, Indochina, and Hungary in 1956, it was only after *Sputnik* the following year that it reached a fevered panic. The object causing the panic was merely a 22-inch sphere weighing only 183 pounds, traveling in an orbit that took it around the Earth every 96 minutes. As one expert has noted, it was actually quite an "unspectacular satellite that probably should not have elicited the horrific reaction it wrought" (Launius, p. 2). Be that as it may, perhaps the greatest source of apprehension was the fact that the "unspectacular satellite" was passing *over* the United States four to six times a day.

However, what the public and press did *not* know—and *could not* know—was that Eisenhower, as early as 1954, had been extremely worried about the impending Soviet threat and acutely aware of the lack of hard intelligence. After the dire warnings of the 1955 classified Technical Capabilities Panel—that the Soviets were already capable of delivering a "fatal" first attack—he had authorized classified U-2 overflights and the development of a classified photoreconnaissance satellite, known as Corona.

In 1954 President Eisenhower had tasked the Science Advisory Committee to study the issue of the danger of a surprise attack on the United States. Presenting its findings to the National Security Council in February 1955, the Technological Capabilities Panel (TCP) was composed of more than 40 scientists and engineers, headed by Dr. James F. Killian, President of the Massachusetts Institute of Technology (MIT). Their two-volume findings—*Meeting the Threat of Surprise Attack*—focused on three areas of national security: continental defense, strike forces, and intelligence. Dr. Edwin H. "Din" Land, founder of Polaroid, was put in charge of the third section on intelligence.

Key findings of Din Land's panel included praise of existing *National Intelligence Estimates* (NIEs) while stressing, however, that analysis could not replace hard facts. The sub-group[20] believed the Soviets had already altered the strategic balance: as of 1955, they believed [mistakenly], the Soviets had enough TU-4 bombers with nuclear devices that could, on one-way missions, reach most targets in the U.S.—and deliver a "fatal" first attack. Moreover, the intelligence panel was particularly concerned about the lack of

20 According to Curtis Peebles, Din Land insisted that no committee should be larger than the number of people who fit into a taxicab. Thus, the unofficial name of the intelligence sub-section became "the Taxicab Committee." See Peebles account, *The Corona Project,* p. 19ff.; and Victor McElheny's biography on Din Land, *Insisting on the Impossible,* p. 294ff.

hard data on what the Soviet capability was with respect to long-range ballistic missiles. Indeed, the sub-section woefully noted that the U.S. knew "next to nothing" (Killian, p. 16).

The TCP findings stressed that offensive capability was just as critical as defensive; the U.S. must proceed as quickly as possible with developing ICBMs but in the meantime should proceed with developing Intermediate Range Ballistic Missiles (IRBMs); that the U.S. needed to urgently develop an aerial reconnaissance capability—preferably to be undertaken not by the Air Force, since it would take too long; that this capability was urgently needed; and finally that the U.S. also needed to embark on a satellite reconnaissance program.[21]

Unaware of these classified developments, however, it was a beeping object orbiting in space—whose emissions actually meant nothing—that fully escalated fear both in the U.S. and throughout the world. While TASS had announced the August ICBM launch, the world had taken little note of it.[22, 23] In the panicked reaction to *Sputnik,* Eisenhower was criticized for being in "partial retirement" and a golf-playing, do-nothing president; the Democratic Governor of Michigan even wrote a satirical poem ridiculing him:

Oh little sputnik, flying high
With made-in-Moscow beep,
You tell the world it's a Commie sky
And Uncle Sam's asleep.

You say on fairway and on rough
The Kremlin knows it all,
We hope our golfer knows enough
To get us on the ball.

—Michigan Governor G. Mennen Williams
(See Roger Launius, "Sputnik and the Origins of the Space Age")

21 It was actually a May 1946 report that had first highlighted the need for the development of satellites, since satellites would "offer an observation aircraft which cannot be brought down." See McDougall, p. 89. The term "RAND" to name the think tank is derived from **R**esearch **an**d **d**evelopment.

22 TASS (Telegraph Agency of the Soviet Union) collected and distributed internal and international news for all Soviet newspapers, radio, and television.

23 Between 1951 and 1957, the Russians had made more than 20 announcements that they were headed for space (Dickson, 96). With the August launch, they warned the world that it was now possible "to direct rockets into any part of the world." But the announcement was not taken seriously in the West. Even the editors of *Time* magazine puzzled over the lack of attention or media coverage in the West of the first ICBM, noting "...the public consciousness and the front pages of the U.S. were occupied largely by domestic matters—the closing battle in Congress, the Teamsters scandal, inflation." See "The Nation: Red Moon Over the U.S." in *Time*, 14 October 1957.

Even though *Sputnik* only transmitted intermittent beeps with no meaning—chirping in the key of A-flat lasting three-tenths of a second, followed by a three-tenths-of-a-second pause—it sowed havoc among Western intelligence analysts. Reportedly, analysts at CIA, Defense Intelligence Agency, Army, Air Force and other Western intelligence agencies worked day and night to see who would be first to decipher the beeps. Columnist Stewart Alsop even suggested that the *Sputnik* "might have eyes to see" (Dickson, p. 113ff).

The element of surprise is what was most jolting: even though the West knew that the Soviets had been making plans for launching a satellite, few in the West actually believed the Soviets were capable of such technological skill. Americans had nothing but disdain for the quality and scarcity of Russian material goods, viewing Soviet cars as decidedly humorously inferior and Soviet consumer goods as being remarkably shoddy, even when available—which was not often.

Sputnik also finally brought world attention back to the August ICBM launch. The American labor leader Walter Reuther referred to Sputnik as a "bloodless Pearl Harbor"; Senator Henry Jackson bluntly declared that the U.S. was "losing the race for the ICBM"; *The New York Times* warned that the U.S. was in a race for survival; Senators Mansfield and Javits called for an immediate "Manhattan Project" approach to missiles and space (Levine, p. 61); and the British *Guardian* pointed out that the Russians could now build ballistic missiles capable of hitting any chosen target anywhere in the world, and that Moscow undoubtedly had a "great lead" in missile technology (Harford, p. 9).

But it was a leak to *The Washington Post* of the classified *Gaither Report* in December, 1957—and the manner in which the Post reporter presented it—that seemed to encapsulate the fears aroused by *Sputnik*. In the previous spring, under the aegis of the Pentagon, the Defense Mobilization Science Advisory Committee, composed of some of the country's leading scientific and defense experts, had begun a general inquiry on U.S. civil defense, but gradually broadened their focus to include U.S. defense policy in general.[24] The scientists and defense experts issued their findings in November 1957. Though the report was classified, the "Security Resources Panel Report"—or the *Gaither Report* as it came to be known—by December had been leaked to *The Washington Post*, and was to become instrumental in stoking public fear.

Not unlike the 1955 TCP findings, the 1957 *Gaither Report*[25] stressed that the U.S. had "...too few solid facts on which to base essential knowledge of U.S.S.R. capabilities...." (*Gaither*, p. 10). The authors of the *Gaither Report* believed the Soviet threat was not merely to be found in the degree of Soviet capabilities in 1957, but primarily in the astonishing pace of development and technological breakthroughs by the Soviets, particularly in light

24 Though now widely referred to as "The Gaither Report," H. Rowan Gaither—a co-director of the study group—became ill in the Spring of 1957 just as the group began its study. See Killian, p. 96ff.

25 Much has been written about the *Gaither Report*. Historians no longer differ on the importance of and the impact of the study. Of some controversy still, however, is the role and intentions of the drafters of the report. Most recently, Richard Rhodes concludes that Paul Nitze and his colleagues on the Gaither Panel—while "victim" to then-current exaggeration of Sino-Soviet advances in 1957—nonetheless *intentionally* "chose to exaggerate the dimensions of the threat." See his *Arsenals of Folly*, p. 109ff.

of the country's poor economic state in 1945. Somewhat marveling at the Soviet recovery, the Panel members assessed that the Soviets "have probably surpassed us in ICBM development" (*Gaither,* p. 4). They warned that the very survival of the U.S. was at stake, and urged "...exploitation of all means presently at our disposal to obtain both strategic warning and hard intelligence, even if some risks have to be taken..." (*The Gaither Report,* p. 10).

Most alarming in the Panel's findings was their belief that as early as 1959 the Soviet Union might have the capacity to launch a surprise ICBM attack—that the USSR would have the capability to launch a destructive first strike.

On 20 December 1957 journalist Chalmers M. Roberts in *The Washington Post* front-page headlines ominously warned that the "still top-secret Gaither Report portrays a United States in the gravest danger in its history" (Roberts, 1957). The U.S. was in danger of becoming a "second-class" power; there was an "immediate" threat from the "missile-bristling Soviet Union" (Roberts, 1957).

But despite public derision after Sputnik, President Eisenhower had quickly taken decisive action. Immediately after Moscow's August 1957 successful ICBM launch, the U.S. Strategic Air Command (SAC) initiated a 24-hour/7 days a week nuclear alert—an alert that remained in effect until 1991. In November 1957 President Eisenhower made the decision to begin stationing Intermediate-Range Ballistic Missiles in Europe—missiles within striking range of Moscow.

With some fluctuation, the tension between the two superpowers appeared to harden between 1957 and 1960, and into the 1960s. What did not help in easing tensions was the personality style of Nikita Khrushchev, whose public threats about Soviet superiority have become legendary. As one expert has noted: "He [Khrushchev] decided to trump American nuclear superiority with Soviet nuclear brinkmanship, using nuclear missiles as the last argument during international crises. His choice resulted in the most dangerous Soviet ventures during the entire Cold War" (Zubok, 2007, p. 124).

During this period, articles began to appear on a regular basis in the press about the so-called "missile gap"—i.e., that the Soviets were far ahead of the U.S. in ICBM development and deployment. In Congressional hearings, the topic was heatedly debated by politicians and defense experts, with Missouri's Democratic Senator Stuart Symington claiming that the U.S. was "asleep at the missile switch" (*Time*, 1959). In the February 1959 article ("Defense: Gap Flap"), *Time* magazine editors claimed that by 1961 the Russians would have four times the number of ICBMs as the U.S.

In the aftermath of *Sputnik,* Korolev proceeded to successfully establish other "firsts" in history with his R-7 launch vehicle. On 12 September 1959, the Soviets launched *Luna 2* from Tyuratam, impacting the moon and enabling the Soviets to claim one more first—the first spacecraft to reach another celestial body. Similarly, *Luna 3,* launched from Tyuratam on 4 October 1959, swung around the moon and, with the sun behind it,

photographed the far side of the moon. The film was developed automatically onboard, scanned by a television unit, and transmitted by radio to the ground (Harford, p. 143ff). A few days after the *Luna 3* mission, a Soviet delegation presented copies of the photos of the moon's dark side to John Stapp, president of the American Rocket Society. Once again, the Americans were forced to admit that the Soviets had beaten them. Finally, Yuri Gagarin became the world's first man in space when he orbited the Earth a single time (in one hour and 48 minutes) on 12 April 1961.

1960: What Did the U.S. Know about Soviet Capabilities?

The lack of intelligence on Soviet strategic capability, needless to say, became even more alarming with the May 1960 Soviet shootdown of the "Operation Grandslam" U-2 mission. When President Eisenhower in 1956 had authorized the CIA to undertake the daring and badly needed U-2 flights, intelligence analysts were astounded with the first photographs of missile bases and launch sites such as Tyuratam. However, often these images were enough to merely stoke fears that there were many more sites in the USSR than the U.S. knew about. Indeed, in July 1960, the CIA estimated that only about 13.6 percent of area in the USSR suitable for ICBM deployment had actually been covered by U-2 imagery (McDonald, p. 332). Analysts, trained to continuously question—what Secretary of Defense Donald Rumsfeld in 2002 came to refer to as the "known unknowns" and the "unknown unknowns"—were deeply concerned about the remaining 85 percent of Soviet territory.

Intelligence collection against the Soviet Union had been difficult ever since the World War II Four Powers Alliance had begun to break down in the late 1940s. The Soviet Union was vast, spread over one of the largest areas of the Earth, with some 11 time zones. In an effort to consolidate the 1917 Bolshevik revolution, in subsequent years the Soviets had erected a highly repressive, centralized police state, where citizens were routinely spied on by the intelligence apparatus, taken into custody without warning, tortured, summarily shot, forced into confessions during a series of show trials in the 1930s, and often simply disappeared into the vast *Gulag* throughout Siberia. Although some of the harsher aspects of the repressive police state were somewhat ameliorated after Stalin's death in 1953, the apparatus of the repressive police state, the KGB and its predecessors, along with a highly disciplined Communist Party elite were irrevocably in place, and were to dominate Soviet culture and society until *Glasnost.*

With the emergence of the Cold War in the late 1940s, gaining intelligence against the Soviet adversary became a critical necessity for the West, particularly since it often appeared as if the Soviet Union's intentions were expansionist, in accordance with classic Marxist-Leninist-Stalinist ideology. The National Security Act of 1947 created many of the institutions—particularly the National Security Council (NSC) and the Central Intelligence Agency (CIA)—that were to emerge on the forefront of countering the emerging superpower during the Cold War. But the Soviet Union was what later became known as a "hard target," meaning penetrating behind the doors of the highly secretive Kremlin to discern intentions—much less capabilities—was to become a major

challenge in coming years. Attempting to recruit human assets behind the Iron Curtain was practically impossible and fraught with danger.

Some of the best early intelligence on the USSR came from captured German aerial photographs that had been taken during World War II (Gaddis, 1997, p. 103ff). In particular, intelligence on early Soviet missile development was woefully inadequate and came from the British MI 6. In a rather daring operation, in 1948 British intelligence officers had posed as archaeologists in Iran and were able to monitor the Soviet test range at Kapustin Yar. But as late as 1950, the CIA had three analysts looking at Soviet missiles (Prados, pp. 57-58).

Since late 1946 when the U.S. first began spy flights along the coast of Siberia under the Peacetime Airborne Reconnaissance Program (PARPO), some—but limited—intelligence had been gained from flights along the periphery of the vast Soviet empire. These flights were only along the periphery—not directly over Soviet territory—but did yield limited intelligence about Soviet air defense, radar, and communication systems (Taubman, P., p. 47; Lindgren, p. 24ff). On 10 May 1949 USAF First Lieutenant Bryce Poe II undertook the first overflight over Soviet territory—the Kuril Islands in the Soviet Far East. Limited peripheral flights were made during the Korean War, and the U.S. Air Force and Navy planes undertook short-range penetration of Soviet and Chinese airspace.

Reportedly, it was actually the British who undertook the first deep overflights, beginning in 1951 and 1952 (Peebles, p. 19). These sorties entailed British RAF Special Duty Flights over Soviet facilities in the Baltic states, Poland, Belarus, Germany, Czechoslovakia, and the Ukraine. It was an RAF Special Duty Overflight in 1953 that snapped the first photograph of Kapustin Yar, where the Soviets had been undertaking missile testing since 1947. This intelligence from the British not only prompted Eisenhower to assemble the Teapot Committee charged with streamlining U.S. missile efforts, but also prompted him to authorize U.S. overflights (Reed, 43).

Overflights initially gave Eisenhower confidence in the adequacy of deterrence. This confidence was eroded, however, as the Cold War widened and deepened and new weaponry permanently altered the world geopolitical landscape in the 1950s.

Ironically to some degree, it was the deluge of photographs from the U-2 program, in conjunction with the sheer size of the USSR, that tended to lead to "worst case" scenarios in Washington, such as the so-called "missile gap" in the late 1950s. As indicated, analysts would extrapolate from the approximately 14 percent of the USSR that the U-2 covered, and assume that in the remaining 86 percent of the USSR there might be many more missile sites and indeed—after August of 1957—actually deployed and operational ICBMs. Arguably, this lack of hard intelligence—and fear about the "unknowns"—not only set in motion the establishment of large U.S. and Soviet defense bureaucracies during the 1950s, but also accelerated the efforts by both sides to quickly develop strategic missile capabilities.

On balance, during the initial stages of the Cold War—between 1947 and 1953—the U.S. tended to underestimate Soviet capability. The general underestimation tended to rest on the assumption that the Soviets were technologically far inferior to the U.S.[26]

Beginning in 1953—in the wake of the Soviets' unexpected hydrogen bomb test and with the results of the initial British imagery that had located Kapustin Yar—the U.S. began to step up efforts to improve its own intelligence collection. By early 1954 and 1955, the U.S. was gaining intelligence on early Soviet missile and technical development via collections stations in Turkey. The long-range radar station in Turkey was intended to keep track of Soviet missiles and was helpful—the U.S. was able to obtain some initial telemetry data of testing at Kapustin Yar. However, these radars could not discern the failures on the launchpad or shortly after launch; nor could they detect telemetry from missile launch activity at Tyuratam. The U.S. would have to wait another six years to be able to do that via national reconnaissance satellites (Zaloga, 1993, p. 152; Lindgren, p. 45; Garthoff, p. 147; Stine, p. 160).

Key targets for initial U-2 photoreconnaissance missions in the 1950s were: the intermediate missile (IRBM) test ranges at Kapustin Yar and Sary Shagan where medium-range ballistic missiles (MRBMs), intermediate-range ballistic missiles (IRBMs), and surface to air missiles (SAMs) were being developed. These early U-2 flights from 20 June to 10 July in 1956 also quickly dispelled the notion that there existed a "bomber gap," intelligence that the White House subsequently used to deny Air Force requests for additional B-52 bombers (Pedlow, p. 111ff).

Unexpected crises—where the U.S. and the West had had no prior warning of impending Soviet action—understandably accelerated efforts to gain more intelligence. Reportedly, it was the unexpected Soviet invasion into Hungary in 1956 that convinced Eisenhower to authorize renewed U-2 flights over the Soviet bloc (Pedlow, p. 123ff).

Although U-2 flights only covered a small percentage of Soviet territory, once a site had been identified, the U.S. could on a regular basis monitor developments at the site. Thus, after the August 1957 U-2 flew along rail lines and confirmed the presence of Tyuratam, it subsequently even took images of the R-7 on its erector launchpad. The U.S. was able to monitor early missile testing activity at Tyuratam until May of 1960 when the shootdown of Gary Powers ended the U-2 flight program.

By mid-1958—after the discovery of Tyuratam, the publication of the *Gaither Report*, and the Soviet's successful ICBM launch—searching for *deployed* ICBMs (the missiles with the range capable of hitting any U.S. city within minutes) became a major intelligence

26 During the past decade, CIA's Center for the Study of Intelligence (CSI) has published a number of excellent analytic essays and collections focused on U.S. estimates during the Cold War. The reader is recommended to begin with: the collection of NIEs entitled *Intentions and Capabilities: Estimates on Soviet Strategic Forces, 1950–1985,* edited by Donald P. Steury; the extremely insightful collection of articles in *Watching the Bear: Essays on CIA's Analysis of the Soviet Union,* edited by Gerald K. Haines and Robert E. Leggett; the collection of early *NIEs* in *Selected Estimates on the Soviet Union, 1950–1959,* edited by Scott A. Koch. For more information, the reader is advised to go to CSI's unclassified website at https://www.cia/gov/library/center-for-the-study-of-intelligence.

priority. By mid-1958, no *operational* ICBMs had been located (Lindgren, p. 49). In late 1959 an NIE (11-8-59) pointed out that the U.S. U-2 flight program had still not identified *operational* ICBMs. Ironically, the 1 May 1960 tragic Gary Powers U-2 flight flew over the Tyuratam ICBM Test Complex and was enroute to the Plesetsk area when it was shot down by an SA-2. Central Intelligence Agency analysts suspected ICBMs might possibly be deployed in the Plesetsk area, but did not know (Lindgren, p. 57).

The greatest degree of wild exaggeration in estimates of Soviet capabilities occurred in the period between 1957 and 1961. As a senior intelligence officer has astutely noted, it was in the "panicked reaction to Sputnik and the first Soviet ICBM test in August 1957...when overestimates began" (Garthoff, p. 5). These NIEs, beginning in late 1957 through mid-1961, by and large tended to particularly overestimate the Soviet ICBM capability. *National Intelligence Estimate 11-10-57* in December 1957 estimated there would be 100 ICBMs deployed by mid-1959 and possibly 500 ICBMs in mid-1961. A 1959 *NIE* predicted the Soviets had between 140 and 200 ICBMs. In reality, the actual number in 1961 was four (Garthoff, p. 5).

It was Corona that ultimately was able to resolve the so-called "missile gap"–i.e., the fear that the Soviets had far more long-range missiles than the U.S. did. More specifically, it was Corona Missions 9017 (July 1961) and 9023 (August 1961) that confirmed that there was no missile gap. Thus the following *NIE 11-8/1-61,* using the "take" from these two Corona missions, estimated the number of ICBM launchers to be 10 to 25—a sharp reduction from the NIE 11-8-59 prediction of 140 to 200 Soviet ICBMs (Lindgren, p. 105; Gartoff, p. 5).

The first Corona images of Plesetsk—one of the targets of Gary Powers' ill-fated May 1960 U-2 flight—was developed in November of 1960, revealing only four operational, deployed ICBMs at Plesetsk—not the *hundreds* intelligence estimates had thought. Indeed, the U.S. intelligence analysts then found themselves puzzling over other enigmas: were there other sites with deployed ICBMs? And what had happened to the Soviet missile program?

1960: Real Soviet Capabilities—The Gambit and Hexagon Legacy

> *"What gave rise to the legend that the Soviets were ahead and the United States was lagging behind? We actually were the first to begin testing intercontinental missiles. We were twelve to eighteen months ahead there and several months ahead in medium-range missiles. The reason is very simple: we were in a great hurry, while they [the U.S.] were not....The intercontinental ballistic missile was the Soviet Union's last hope for parity in the arms race."*
>
> —Nikita Khrushchev, *Memoirs Vol. II*

> *"My only regret after thirty years of developing missiles and space launchers is that it took until the end of 1975 before we managed to deploy a truly effective missile system."*
>
> —Nikolai Nillayevich Smirnitskiy in 1995, Served as Deputy Commander-in-Chief of the Strategic Rocket Forces, 1949–1975 (Rhea, p. 115)

In retrospect, it was actually only a few short years, between 1957 and 1961, that an argument could be made that at least briefly, the U.S. was "losing" the arms and space race. Beginning in August of 1960, Corona imagery revealed to what degree the *NIEs* had widely exaggerated the number of Soviet missiles. But it would be Gambit imagery—KH-7 beginning in 1963, and particularly higher-resolution KH-8 imagery beginning in 1966—that would enable insight into the technical challenges facing the Soviet missile program, challenges that caused the Soviet missile program to lag behind that of the U.S. by the early 1960s, after Moscow's initial successful salvo. In short, it was Gambit and later Hexagon—in conjunction with overhead sigint platforms—that could address the July 1960 U.S. Intelligence Board SIRC report on urgent intelligence gaps, and calling for *greater search* and *surveillance*, more *detailed* intelligence on ICBM installations and *greater technical specificity*.

What Gambit and Sigint platforms began to reveal was that despite the 1957 "firsts," the Soviet program from its very inception had been plagued by a series of problems—many technical, many due to the poor Soviet economy, and some due to the direction the early Soviet missile program had taken. After his successful R-7 ICBM launch, Korolev went on to use the R-7 launch vehicle to achieve his greatest accomplishments in the space race—where his heart actually lay. But his R-7 launch vehicle—while serving as an excellent space launch vehicle—was ultimately not a successful foundation for a Soviet ICBM deployed arsenal. Indeed, subsequent experts—while acknowledging Korolev's outstanding achievements, particularly in space—have used varying pejorative terms in describing Korolev's R-7 as an ICBM: as a "monster" (Stine, p. 242) and a "blunder" (Levine, p. 46).

Between 1957 and 1960, however, the Soviets did not appear to be aware of the R-7 shortcomings. Moscow had ambitious dreams. For example, it planned 12 launchers for Tyuratam. (Only four were eventually built.) Khrushchev himself was one of the most enthusiastic supporters of Korolev's missile, planning a plethora of missile bases throughout the U.S.S.R., and in 1959 creating the Soviet Strategic Rocket Forces—a group of carefully selected Soviet soldiers to form an elite force. He and the inner circle of the Politburo believed that focusing on building a large strategic arsenal would also help the USSR deal with its persistently dismal poor economy, allowing Moscow to cut back on its very large and expensive standing conventional army.

From its very inception, however, the Soviet program had been beset with constant delays due to the poor state of Soviet industrial capability. This is particularly seen in the difficulties in the construction of Plesetsk, one of the critical targets of Gary Powers' May 1960 ill-fated U-2 mission. Building Plesetsk (in the northwest corner of the U.S.S.R., not far from the Baltic Sea) was important to Moscow because the R-7 range of 8,000 km was not sufficient for Korolev's missile to reach the entire U.S. from Tyuratam. Work to construct the base began in July of 1957. But not unlike many Soviet undertakings, due to persistent problems in material (e.g., the poor Soviet metallurgy capability) and lack of needed construction supplies, there were constant delays in finishing the range at Plesetsk. Indeed, because of the continuous delays, at a 1958 Plesetsk program review meeting Khrushchev's temper supposedly exploded, and he cancelled the entire Plesetsk

program. He relented, but the R-7 deployment was scaled back.

Meanwhile, between August of 1957 and April 1958, Korolev proceeded with a flurry of further testing of his R-7 at Tyuratam, some 10 to 15 tests in all. However, none of these flights went beyond 6,000 kilometers. Then there was a pause in testing until March 1959. Why? What had happened to the Soviet program?

Between 1960 and 1966, Moscow actually was only capable of deploying a limited number of operational ICBMs [See Table 1]—not the feared hundreds in *NIEs.* By the mid-1960s the Soviets would be able to recover from the delay to some degree, but it was not by relying on the R-7 or even its R-9 successor, but by building the bulk of its fleet of long-range ballistic missiles from the shop of one of Korolev's rivals, Mikhail Yangel. It was Yangel's R-16 series—and by 1970 Vladimir N. Chelomei's UR-100 series—that were to comprise the backbone of the deployed Soviet ICBM fleet.

Korolev's R-7 series proved to be an erroneous start, due to multiple factors. Some examples:[27]

Sheer size and weight of initial hydrogen warheads. Korolev's early missiles had to be extremely large in order to carry and launch the massive early thermonuclear warheads. For example, the R-7 payload was 5.4 tons compared to the U.S. Atlas with a payload of only 1.8 metric tons. Gradually, however, the Soviets began to develop the capability of reducing the size and weight of thermonuclear warheads—such as those mounted on Korolev's R-9 (Zaloga, 1993, p. 192 ff).

Consequent sheer size of booster. This tremendous size and weight of initial Soviet hydrogen warheads meant that the R-7 had to be very large, adding additional transportation and production challenges. However, even aside from the early hydrogen warheads, the unwieldy weight of the booster was also a result of Soviet backwardness in metallurgy (Levine, p. 45). In contrast, Yangel's R-16 had a throw-weight only a third of the R-7's and a more compact warhead.

Lack of strategic surprise—time delay due to the type of fuel. While the U.S. had solid fuel as early as 1962 (the Minuteman), solid fuel motors were outside Soviet technological capability at the time (Zaloga, 1993, p. 193). Korolev used liquid oxygen (LOX), whereas Yangel used hypergolic fuel—nitric acid as the oxidant and an improved kerosene derivative. Both types of fuel had disadvantages: as liquids, they were both extremely volatile and dangerous. But Korolev had a long-standing aversion to hypergolic-fueled rockets and called Yangel's nitric acid "the devil's venom." His fuel—unwieldy and impractical—could not remain in the missile for any length of time; sun and heat caused LOX to change back to its natural gaseous state. Thus, Korolev R-7 missiles required

27 Beginning with *Glasnost* in 1989, and with the opening of many Soviet archives after 1991, the West has gradually been gaining even more precise understanding of Soviet missile and space development. For some of the more insightful secondary sources in recent years, see Mike Gruntman's *Blazing the Trail; Russian Strategic Nuclear Forces,* edited by Pavel Podvig; Alan Levine's *The Missile and Space Race;* G. Harry Stine, ICBM; Steve Zaloga's *Target America* and *The Kremlin's Nuclear Sword;* and James Harford, *Korolev.*

24 hours to ready for launch, whereas Yangel's fuel could sit in a missile for as long as six months and required only 30 minutes to fuel. This slow launch time in Korolev's missiles became even more critical after 1959 with the development of early warning radars (Khrushchev, p. 459ff). To evade radar detection, the Soviets needed to develop a missile capable of being launched within 30 minutes of warning.

Guidance system. What the West did not know in 1960 is that the USSR had not solved the guidance system problem. While the R-7 had reached a range of 7,000 kilometers, the USSR could only direct it to a target by placing radio guidance systems every 500 kilometers along the way—making the R-7 unreliable (Levine, p. 46; Khrushchev, p. 459; Taubman, W., p. 379).

Even aside from the drawbacks of Korolev's R-7 missile, however, there were delays in production, development, and deployment of both Korolev's and Yangel's types of ICBMs due to a multitude of factors. Some examples:

Both the R-7 & R-16 series were hastily made. The R-7, R-8, and the R-16 were rushed as Moscow—lacking strategic surprise capability in their intercontinental strategic bomber arsenal—saw ICBM deployment as Moscow's only viable offensive weapon against the U.S. For example, engine tests on Yangel's R-16 began in 1959 but by 1960 the first missiles began to move off the assembly lines at Dnepropetrovsk for shipping by rail to Tyuratam. This push to develop new missiles rapidly resulted in tragedy and setbacks to the Soviet program. For example, on 23 October 1960, an R-16 exploded on the launchpad at Tyuratam. Between 100 and 200 men were killed, including the Soviet Commander Marshall Nedlin and the leadership of Yangel's design team, leading to a major setback for the R-16 (Zaloga, 1993, p. 195ff). Tests of the R-16 did not resume until 1961.

Generally poor Soviet economy. At the time Sputnik was launched, requirements of new armament far surpassed allocated resources. Procurement costs for strategic missiles were about 1.4 million rubles apiece in 1962 prices; funding for the strategic program was often lacking, with Moscow, for example, at one point having to scrap the last three years of the Five-Year-Plan (Zaloga, 1993, p. 152).

Basing systems and silos. At Tyuratam, the Soviets developed elaborate basing stations which in turn delayed the Soviet need to move to silos. The first R-16s deployed in 1962 used above-ground launch systems (Zaloga, 1993, p. 198ff).

Cost and challenges of silo construction. In 1961, Khrushchev had called for the construction of hardened silos. But this effort proved to be very difficult and expensive, resulting in many delays. The first of the "Sheksna" silo launch complexes were finally ready by 1964, but the majority of R-16 missiles remained based in unprotected coffin launchers.

By 1960 the Soviet program was faced with multiple challenges. Only a few days after Khrushchev's October 1960 United Nations speech where he bragged that the Soviet

Union was producing "missiles like sausages," the first of Yangel's R-16s exploded as it was being prepared for firing at Tyuratam (Harford, p. 118).

In short, due to a multitude of factors, by 1960 the Soviets actually had only about 20 operational missile launchers, most of which were untested or simply training models: four launchers at Plesetsk, several training launchers at Tyuratam, and new untested R-16 missile launchers being installed at Yura (Zaloga, 1993, p. 213). In contrast, the U.S. had 60 operational in 1960, so the so-called "missile gap" was simply a myth, capturing U.S. fears and lack of hard intelligence, but little more.[28] While Corona enabled "counting" of the real number of deployed ICBMs, it would be Gambit and Hexagon that would provide the type of technical detail and surveillance needed to understand the quality of Soviet ICBMs (allowing for example "continuous observing" of an ICBM site to discern fuel handling, silo loading etc). Among other capabilities, these systems enabled:

Penetration of Soviet ICBM silos. Between 1957 and 1960, the Soviets began to be concerned about the vulnerability of the nascent R-7 ICBM fleet. Thus, in 1961 Soviet Premier Nikita Khrushchev ordered the development of hardened missile silos, since silos would make it difficult for the U.S. to locate and verify the missile silos (Khrushchev, p. 463ff). Gambit and Hexagon were capable of doing what Corona had been unable to do—namely, locate and provide needed intelligence on the hardened silos.

Gaining intelligence on Antiballistic Missile installations. Between 1959 and 1963, the Department of Defense and U.S. intelligence analysts became increasingly aware that the Soviets were developing antiballistic missile installations. Analysts believed a site existed at Leningrad, but they needed greater specificity about it.

Surveillance of critical Soviet sites. Analysts needed to have continuous "watching" (surveillance) of ICBM sites in particular, intelligence that would allow them to gain a better comprehension of the Soviet ICBM program: How did the Soviets fuel the R-7? How long did it take? And as the Soviets began to build silos, how long did it take to load a missile? What could analysts learn about the technical characteristics of the missile by continuously watching Soviet Strategic Rocket Forces handle the R-7 over a period of days and even weeks?

Identification of materials of Soviet strategic arsenal. Since the U.S. had no means of covertly acquiring a Soviet ICBM and almost certainly no human assets in the U.S.S.R. that could assist in identifying the materials used in the missiles, U.S. intelligence officers needed imagery with resolution sharper than Corona imagery, imagery that would enable the U.S. to learn more about not only missiles, but also bombers, antiballistic radar sites, etc. Beginning in 1966, Gambit's KH-8 imagery would allow the U.S. Intelligence Community for the first time to assess technical capabilities of strategic systems, based on a

28 A great deal has been written about the so-called "missile gap"—a much too exhaustive bibliography than possible for this article. For an introductory overview, see David Lindgren's *Trust But Verify;* Neil Sheehan's *A Fiery Peace in a Cold War;* Alan Levine, *The Missile and Space Race;* and publications from CIA's Center for Studies in Intelligence (CSI).

clearer understanding of the materials used.

It was not until 1966 that the Soviets began to recover from their "misadventure" with the R-7 missile and Moscow began to actually deploy—in large numbers—Yangel's R-16 (50 in 1962 and 202 in 1965) [See Table 1]. And it would be the resolution of Gambit imagery in conjunction with the surveillance of Hexagon in conjunction with Sigint platforms that would allow the U.S. to gain insight into the technical characteristics of the Yangel's missiles, as well as greater insight into what had happened to the Soviet ICBM effort after the truly remarkable beginning between 1957 and 1960.

EARLY SOVIET BALLISTIC MISSILES: NOMENCLATURE

USSR Number		Western Number		Type	Designer
R-1	8A11	SS-1	Scunner	IRBM	Korolev
R-11	8A61	SS-1b	Scud-A	IRBM	Korolev
R-2	8Zh38	SS-2	Sibling	IRBM	Korolev
R-5	8A62	SS-3	Shyster	IRBM	Korolev
R-12	8K63	SS-4	Sandal	IRBM	Yangel
R-14	8K65	SS-5	Skean	IRBM	Yangel
R-7	8K71	SS-6	Sapwood	ICBM	Korolev
R-16	8K64	SS-7	Saddler	ICBM	Yangel
R-9A	8K75	SS-8	Sasin	ICBM	Korolev
R-36	8K67	SS-9	Scarp	ICBM	Yangel
UR-100	8K84	SS-11	Sego	ICBM	Chelomei

EARLY SOVIET BALLISTIC MISSILES: DEPLOYED

		Type	1960	1962	1965	1970
R-5	SS-3	IRBM	36	36	20	—
R-12	SS-4	IRBM	172	458	572	504
R-14	SS-5	IRBM	—	28	101	89
R-7	SS-6	ICBM	2	6	6	—
R-16	SS-7	ICBM	—	50	202	195
R-9A	SS-8	ICBM	—	—	26	26
R-36	SS-9	ICBM	—	—	72	270
UR-100	SS-11	ICBM	—	—	—	930

Table 1. Soviet Missile Deployments and Nomenclature, 1960–1970

Source: Mike Gruntman, *Blazing the Trail: The Early History of Spacecraft and Rocketry (2004).*

Why Gambit & Hexagon: Retrospect and Post-1960

> *"I have been shown photographs of airplanes taken from orbit by satellites. You can tell exactly what type of planes they are....I've seen [American] photographs. They are more precise than ours."*
>
> —Nikita Khrushchev, dictated Memoirs, 1966-1970[29]

29 Since he dictated/drafted his Memoirs between 1966 and 1970—and specifically refers to satellite imagery distinguishing airplane models and types—Khrushchev is probably referring to Gambit imagery. See the 2005 *Memoirs* edited by his son Sergei, p. 462.

> *"In the 1970s and 1980s the 'national technical means' of surveillance, as photoreconnaissance satellites were called, gave sufficient transparency through the Soviet Union's Iron Curtain that the U.S. could enter into strategic arms negotiations to control and eventually start to reduce the threat of nuclear weapons mounted on large delivery systems of intercontinental ranges.... compliance with treaty limitations could* be verified."
>
> —Sidney D. Drell, "Physics and U.S. National Security,"
> *Review of Modern Physics, Vol. 71, No. 2 Centenary 1999,* p. S460.

The Gambit and Hexagon missions were accordingly a direct response to events between 1957 and 1960. The Soviet "firsts" shocked the American public, producing a near-panic that the 1957-leaked *Gaither Report* only intensified. As the broad American public became more aware of the danger posed by the new weaponry—particularly the horrifying implications of a Soviet ICBM force—U.S. government officials were actively finding solutions to counter not only the threat of a Soviet surprise attack, but the potential of a Soviet first-strike capability that might even entail the destruction of the West.

After its first successful launch in August of 1960, although the quality of Corona's imagery was initially not the best (particularly even compared to later Corona improvements), the Corona system irrefutably dispelled the "missile gap" myth. By 1961 the U.S. Intelligence Community was estimating the number of Soviet ICBM launchers to be 10 to 25—not the 140 to 200 estimated in the 1959 *NIE*. During 1961 and 1962, Corona discovered R-16 (Yangel) and R-9A (Korolev) ICBM missile complexes under construction at Yurya, Verkhnyaya Salda, Yoshkar Ola, Teykovo, Svobodnyy, Perm, Kostroma, and Itatka. In 1963, the Kozelsk, Drovyanaya, Gladkaya, Shadrinsk, and Yedrovo ICBM complexes were discovered. And by 1962, Corona had identified most of the Soviet MRBMs and IRBMs targeting Europe and Japan. As analysts began to produce National Intelligence Estimates with the benefit of Corona imagery, Sherman Kent astutely remarked that they were no longer "estimates," but rather "factbooks" (NPIC, p. 34, 35).

Drawing on this legacy, Gambit and Hexagon would fulfill in spades the July 1960 SIRC mandate that the U.S. needed greater surveillance and greater technical detail on Soviet strategic forces. High-resolution Gambit could provide the kind of specificity needed by scientific and technical (S & T) intelligence officers: for the first time, U.S. intelligence officers had detailed information and accurate mensuration data to develop engineering drawings on foreign weapon systems. The U.S., for example, was even able to carefully monitor the Soviet development of Yangel's R-16 and R-36. Hexagon could cover thousands of square nautical miles with contiguous, high-resolution imagery in a single operation, for intelligence and mapping, and charting, and could provide order-of-battle information across entire Soviet military districts. The two systems often worked in tandem, enabling regular monitoring at a site, thereby giving U.S. analysts greater understanding of the quality of Soviet strategic forces and weaponry, production, and

helped identify military communications equipment, monitor types of Soviet aircraft, etc. As the Soviets began to develop a mobile missile force, the systems could monitor their early development and provide invaluable insight.

By the 1980s, however, technological advances allowed the Soviets to produce lighter and more agile strategic weapons, with new types of mobile ICBMs and multiple reentry vehicle warheads (MIRVs). Accordingly, as one expert has noted, with the new technology, Moscow was able at least in the area of ballistic missiles to counter the powerful intelligence benefit of film-return systems such as Gambit and Hexagon. It was new U.S. national reconnaissance capabilities such as near-real time and other approaches that would assist in detecting and monitoring missiles with the new capabilities (Berkowitz, p. 109). However, monitoring mobile missiles and gaining greater detail about multiple warhead reentry vehicles had been made easier through two decades of Corona, Gambit, and Hexagon imagery locating and identifying all the missile and other strategic sites in the vast territory of the U.S.S.R., as well as providing the technical and specific data needed on the Soviet strategic program. Moreover, after two decades of analyzing Corona, Gambit, and Hexagon imagery, imagery intelligence analysts had developed the techniques and methodology of a honed "science."

Finally, in the Cold War stalemate, these systems played a critical role in enabling a significant thaw in tensions—the needed-verification mechanism (lacking in the 1950s during initial efforts to achieve a limitation on nuclear testing) for a series of arms control treaties: the Limited Test Ban Treaty, 1963; strategic arms limitation treaties (SALT I in 1972 and SALT II in 1979); and the Anti-Ballistic Missile (ABM) Treaty, 1972. In addition, the systems paved the way in the 1970s and 1980s for national reconnaissance near real-time imagery to provide verification, allowing Moscow and Washington to finally enact Eisenhower's "Open Skies" vision from the 1950s by signing the Treaty on Open Skies in 1992; and enabling the most comprehensive reduction of strategic weapons between Moscow and Washington, the 1987 Intermediate Range Nuclear Forces (INF) and the 1991 Strategic Arms Reduction (START) treaties.

It had begun in 1957 with the panicked reaction in the West for what had been unexpected and was truly remarkable about Korolev's achievements at Tyuratam, in rapid succession: the world's first ICBM, the world's first satellite, the first spacecraft to impact a celestial body *(Luna 2),* the first photographs of the far side of the moon *(Luna 3),* and the world's first manned spaceflight in 1961.

It had all started at Test Launch #1 at Tyuratam.

Figure 1. KH-8 Image of Space Booster at the Tyuratam Missile Test Center in the Former Soviet Union, 19 September 1968

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Chronology of Selected Key Events for "Why Gambit & Hexagon?"

Date	Event
6 Aug 1945	The U.S. drops a nuclear bomb on Hiroshima in an attempt to bring the World War II Pacific War to an end
22 Feb 1946	U.S. Charge d'affaires in Moscow George Kennan sends historic 8,000-word telegram to State Dept, warning of Moscow's alarming intentions in foreign policy
July 1947	U.S. Charge d'affaires in Moscow George Kennan outlines a policy of containment for dealing with Soviet expansion
26 July 1947	The U.S. Congress passes the National Security Act, establishing both the National Security Council (NSC) and the Central Intelligence Agency (CIA)
24 June 1948	Soviet Premier Joseph Stalin orders a blockade of all land routes from West Germany to Berlin
July 1948	Soviet physicist Andrei Sakharov begins development of "Layer Cake" concept for hydrogen bomb
15 May 1949	Communists win election in Hungary
29 Aug 1949	The Soviet Union successfully tests its first atomic bomb
1 Oct 1949	Mao Zedong establishes the People's Republic of China
31 Jan 1950	President Truman announces his decision to develop the hydrogen bomb
Feb 1950	Joint Intelligence Committee predicts buildup of Soviet atomic arsenal and possible attack against U.S. "at earliest possible moment"
16 Feb 1950	The Soviet Union and the People's Republic of China sign a pact of mutual defense (the "Sino-Soviet Pact")
24 Feb 1950	U.S. Joint Chiefs of Staff request "all out effort to build H-bomb"
7 Apr 1950	National Security Council document NSC-68 warns of surprise attack by Soviet Union once "it has sufficient atomic capability"
17 Apr 1950	Ambassador Paul Nitze issues NSC-68, with containment as the cornerstone of U.S. policy for the next 20 years
22 June 1950	North Korea invades South Korea
Mar 1952	The Royal Air Force and the Strategic Air Command begin flying photographic and radar reconnaissance missions over the Soviet Union
1 Nov 1952	The U.S. tests the world's first thermonuclear bomb at Eniwetok in the Pacific—10.4 megaton "Mike," nearly 700 times more powerful than bomb exploded at Nagasaki
Dec 1952	President-elect Eisenhower and staff develop "New Look" defense policy relying primarily on power of atomic forces
Aug 1953	General Edmundson leads "Operation Big Stick," which requires him to take 20 B-36s, armed with nuclear weapons, to Okinawa in Japan
12 Aug 1953	First test of Soviet thermonuclear device (Andrei Sakharov's "Layer Cake") takes place
End of 1953	Politburo charges Korolev with task of creating an ICBM large enough to carry the heavy Soviet hydrogen warhead
12 Jan 1954	Secretary of State John Foster Dulles announces administration policy of "massive retaliation" in response to Communist attacks
21 Jan 1954	The U.S. launches the world's first nuclear submarine, the USS Nautilus
14 Sep 1954	44,000 Soviet troops take part in a military exercise involving the dropping of an atomic bomb via an aerial bomber

Date	Event
18 July 1955	The Geneva Summit takes place, attended by President Eisenhower, Prime Minister Anthony Eden of the UK, Premier Nikolai A. Bulganin of the Soviet Union, and Prime Minister Edgar Faure of France. However, talks to reach an arms control treaty eventually falter, due to the lack of verification capability
Nov 1955	Soviets successfully test the hydrogen bomb
Feb 1956	The Soviets hold their Twentieth Party Congress of the CPSU
20 June 1956	First U-2 overflight; Mission 2003 flies over Warsaw Pact countries
4 July 1956	First U-2 mission over the Soviet Union
5 July 1956	Second U-2 overflight of denied territory from Wiesbaden, West Germany. Mission 2014 photographs locations in Warsaw Pact countries, as well as Moscow. This mission dispels myth of the existence of the U.S.-Soviet "bomber gap
10 July 1956	U-2 stand-down ordered after Soviet Union lodges formal protests of repeated American violations of Soviet and East Bloc air space
Aug 1956	Project Rainbow begins in first-ever attempt to make operational aircraft stealthy by adding radar-cancelling devices to the U-2
July–Oct 1956	Suez Crisis: After Egyptian President Nasser nationalizes the Suez Canal, France, Israel, and the UK attack Egypt
29 Aug 1956	U-2 reconnaissance overflights of the Middle East seek evidence of war preparations
4 Nov 1956	Soviets invade Hungary
20 Nov 1956	U-2 overflights resume with Mission 4016, piloted by Francis Gary Powers
Aug 1957	U-2 overflight confirms the existence of a suspected Soviet ICBM test site at Tyuratam (Baikonor)
28 Aug 1957	U-2 Mission 4058 photographs locations in and around Dushanbe, Tashkent, Tyuratam, Kazalinsk, and Aral Sea regions in the USSR
Aug 1957	Soviets successfully test the world's first ICBM (Korolev's RS-7)
1 Oct 1957	The U.S. Srategic Air Command (SAC) initiates a 24/7 nuclear alert in response to Soviet ICBM capability—a 24/7 nuclear alert that remains in effect for the next three and a half decades (1991)
4 Oct 1957	Soviets successfully launch the world's first satellite from Tyuratam on a Korolev R-7 booster—*Sputnik*
Aug 1958	The U.S. deploys Thor Intermediate-Range Ballistic Missiles (IRBM) in the U.K., within striking distance of Moscow
Sep 1959	From Tyuratam, Soviets successfully launch Luna 2 with a Korolev R-7 booster—the first spacecraft to reach another celestial body when it impacts the moon
Oct 1959	Soviets launch *Luna 3*—from Tyuratam, on a Korolev R-7 booster
31 Oct 1959	The U.S. deploys the first operational intercontinental ballistic missile (ICBM), the Atlas D
Dec 1959	Soviet Premier Nikita Khrushchev creates the Soviet Strategic Rocket Missile Force with the underlying belief that strategic nuclear missiles could serve as the basis of the Soviet armed forces, and by augmenting a reduced conventional force, would help Moscow's ailing economic straits
Apr 1960	Jupiter IRBM deployment to Italy begins: ballistic missile within strike range of Moscow
1 May 1960	The Soviet Union shoots down Francis Gary Powers' U-2 reconnaissance plane. Key targets of the mission were Tyuratam, Kyshtym, and Sverdlovsk
June 1960	Khrushchev at UN Assembly in New York pledges support for "wars of national liberation" throughout the world
15 July 1960	U.S. Satellite Intelligence Requirements Committee (SIRC) submits report to the U.S. Intelligence Board calling for Corona follow-on satellite systems with a greater search system (capable of locating suspected ICBM launch sites at a resolution of 6 meters on a side), and a system with a resolution approaching 1.5 meters in order to obtain more descriptive and detailed information about ICBM sites and missiles

Date	Event
18 Aug 1960	First Corona intelligence image: Mys Shmidta Air Base, U.S.S.R.
Aug 1960	The U.S. National Security Council approves the establishment of the National Reconnaissance Office (NRO)
Oct 1960	Soviet Premier Nikita Khrushchev visits the U.S. and warns that the Soviet Union is "manufacturing missiles like sausages"
12 Apr 1961	The Soviet Union successfully launches Vostok 1—Yuri Gagarin becomes the first human in space and first to orbit the Earth; launched from Tyuratam on a Korolev R-7 booster
June 1961	Jupiter IRBM deployment in Turkey begins—missiles within striking distance of Moscow
28 July 1961	Khrushchev orders the acceleration of the construction of hardened silos for missiles
16–29 Oct 1962	Cuban Missile Crisis. The U.S. blockades Cuba for 13 days; ensuing compromise entails U.S. secretly removing deployed IRBMs from Turkey
Aug 1963	U.S.–U.S.S.R. establish "hotline"
5 Aug 1963	U.S. President Kennedy and Soviet Premier Nikita Khrushchev sign the Limited Nuclear Test Ban Treaty
26 May 1972	In Moscow, U.S. President Richard Nixon and Soviet General Secretary Brezhnev initial the Strategic Arms Limitation Treaty (SALT I)
1980s	Moscow begins ambitious strategic modernization program entailing deployment of multiple independently targeted reentry vehicles (MIRVs)—not constrained by the SALT Treaty

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